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The underlying PCT Application No. PCT/EP00/09427 includes an International Search Report, dated April 2, 2001. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.


Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,

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**CUSTOMER NO. 26646**

## DEVICE FOR CONTROLLING A TELECOMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

The present invention ~~is directed~~ relates to a device for controlling a telecommunications system made up of a plurality of networks, the networks being designed for services or parts of services, a network management device being assigned to each network, and the network management devices being controllable by service management devices.

BACKGROUND INFORMATION

In the broadest sense, telecommunications systems are made up of a plurality of networks, several of which are interconnected, depending on the particular requirement, to establish an end-to-end connection. To control and monitor such systems, a functional management architecture is required, as described, for example, in ITU-T recommendations, in particular M.3010. A management architecture of this kind is schematically illustrated in Figure 2.

The lowest layer contains network elements NE, which are each managed by an element management device EMS. Above that, resides a layer made up of network management devices NMS, to which service management devices SMS are linked at a higher level. The functions of service management device SMS can be assumed, in part, by the customers themselves. This function is referred to as customer network management CNM. To manage the entire communications system in terms of business operations, the business management device BMS is then used.

In a nutshell, the network management devices are responsible for monitoring and controlling the network elements situated in one geographic region, while the contractual aspects of the services provided to the customers are the focus of the service management device{s} ~~(these)~~. These include, inter alia, service orders, service complaints, and billing/accounting{}}. In this connection, the concepts "NMF = network management function" and "SMF = service management function" were introduced for the functionalities allocated to the respective management layers.

~~{An important}~~ A capability of the communications system is to make available so-called end-to-end connections, a plurality of networks being required depending on the type of connection. To provide this as a most versatile possible service, the service management devices must, therefore, access a multiplicity of network management devices NMS. The result in the ~~{known}~~ available systems is, therefore, a so-called many-to-many relation, as illustrated in Figure 3. In the process, the number of interfaces required between the network management devices NMS and the service management devices SMS quickly becomes virtually unmanageable.

#### SUMMARY OF ~~The object of the~~ THE INVENTION

The present invention ~~{is to}~~ provides a device and method for controlling a telecommunications system made up of a plurality of networks, which ~~{, without entailing the mentioned disadvantages,}~~ will enable the service management devices to access the network management devices required for the particular services.

~~{This objective is achieved in accordance with the}~~ The present invention ~~{by providing}~~ further provides domain management devices, which enable the service management

devices to access network management devices. The domain management devices, in turn, have access to selected network management devices and are each able to be linked to a service management device.

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The ~~{device according to the }~~present invention further provides a device which requires a substantially smaller number of interfaces at the service management devices and the network management devices than ~~to~~  
10 ~~known~~ available devices.

~~{One advantageous embodiment of the device according to t}~~  
15 ~~t}~~The present invention further provides for a controllable matrix for linking the service management devices to the domain management devices. ~~{It is preferably provided, in this context, }~~The present invention further provides for the controllable matrix to be controlled in conformance with the end-to-end connections to be managed in each instance.

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~~{A further refinement of the device according to t}~~  
25 ~~t}~~The present invention further provides for at least one customer network management device to be connectable via the matrix. This renders possible a dynamic allocation between the particular network management devices and customer network management devices, without entailing additional outlay for switching equipment.

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30 ~~Exemplary embodiments of the present invention are represented by several figures in the drawing and are elucidated in the following description. The figures show:~~

~~Figure 1 }~~

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of an exemplary

embodiment~~{,}~~ according to the present invention.

Figure 2~~{,}~~ shows a schematic representation of {the  
known}an available multilayer concept in  
5 accordance with the ITU-T recommendation{,},

Figure 3~~{,}~~ shows an exemplary schematic representation  
of the many-to-many relations between service  
management devices and network management  
10 devices{,} according to the present invention.

Figure 4~~{,}~~ shows a block diagram of a further exemplary  
embodiment{,} according to the present  
15 invention.

Figure 5~~{,}~~ shows a block diagram of a domain management  
device employed in the device according to  
~~{Figure 4,~~

~~Figure 6 an example of an}~~ the exemplary embodiment of  
20 Figure 4 according to the present invention.

Figure 6 shows an exemplary end-to-end connection  
traversing a plurality of networks which are managed by a  
device ~~{in accordance with}~~ according to the present  
25 invention{, and}.

Figure~~s}~~ 7 ~~{through 9 tables for}~~ shows a table  
illustrating ~~{the}~~ certain improvements ~~{~~ effected  
30 ~~{by}~~ according to the present invention.

Figure 8 shows a table illustrating certain improvements  
effected according to the present invention.

Figure 9 shows a table illustrating certain improvements  
35 effected according to the present invention.

#### DETAILED DESCRIPTION

According to the present invention, Figure 1 illustrates three service management devices SMS, each of which is connected to three domain managers DM, to which three or two network management devices are connected, in turn. A comparison to Figure 3 reveals that substantially fewer interfaces are needed than is the case when working with ~~{the known device.~~

~~In the exemplary embodiment in accordance with Figure 4, }an available device.~~

According to the present invention, Figure 3 illustrates five service management devices 1 through 5~~{are}~~ able to be connected via a matrix 6, in the following, also referred to as a correlation matrix, to five domain managers 7 through 11. Domain managers 7 through 11 have access to network management devices, of which~~{merely}~~ three network management devices 12, 13, 14, are shown as examples in Figure 4.

Also connected to correlation matrix 6 is a server 15 for the customer network management. Moreover, correlation matrix 6 is connected to two databases 16, 17, one being used as database KD DB (customer database), and the other as database SLA (= service level agreement). Server 15 can exchange data via two layers 18, 19 with customer devices 20, layer 18 providing a suitable operational structure in the sense of a corporate identity, identifying the telecommunications carrier, while layer 19 is designed as a security layer. In addition, each of network management devices 12, 13, 14 has assigned B-CNM (= basic customer network management) devices, whose data are fed to server 15.

~~{For further clarification of the exemplary embodiment in~~

~~accordance with Figure 4, reference is first made to~~  
~~Figures 4 and 5.~~ Figure 5 depicts the functional units  
of a domain manager 7 through 11 (Figure 4). In this  
context, a management information distributor 31 is  
5 employed for the connection to correlation matrix 6  
(Figure 4). A further data processing device 32 is used  
for data preparation, for precorrelation, and for  
converting from NMF to SMF. Subsystem adapters 33, 34,  
35, of which ~~merely~~ three are shown illustratively in  
10 Figure 5, are used for the connection to the particular  
network management devices.

In parallel to service management devices 1 through 5,  
the service-oriented information is supplied to customer  
15 network management server 15. This ensures a uniform,  
comprehensive method for accessing the CNM information.  
The customer databases, domain-, service-, and  
customer-network management devices are linked with the  
aid of correlation matrix 6, employing an object-based  
20 communications infrastructure, which supports an  
end-to-end service correlation and renders possible a  
flexible modeling of complex services by combining the  
information communicated by the domain managers.

25 This communications infrastructure enables the  
service-relevant interconnection objects of various  
domain managers to be queried by the responsible service  
management device SMS, and for status modifications to be  
routed by the domain managers in dedicated fashion to  
30 service management device SMS. In addition, it provides  
the basis for transmitting customer queries from the  
customer network management system to service management  
device SMS and vice versa, to make available information  
of relevance to the customer, from service management  
35 device SMS via the customer network management system.  
Also the basic information for the correlation is fed via

this communications infrastructure to the domain managers, service management devices SMS, and to the customer network management systems.

5 The functionality of the domain managers resides in the adaptation of the subsystems, in the conversion of the network management information received from the subsystems, from the domains of fault, performance, and configuration management, into service-oriented  
10 information, as well as in the conversion of requests received from the service management devices into network management requests, and in the routing of such requests to the appropriate network management devices. The interface directed to service management devices is  
15 designed as a standardized, object-oriented interface, and is integrated in the communications infrastructure. Moreover, the domain manager assures the bidirectional exchange of information, and that the requests contained in the security concept with respect to access  
20 restrictions to the network management devices and with respect to the integrity and confidentiality of the data are observed (security management functions).

Figure 6 depicts the networks and management devices used  
25 for a frame-relay end-to-end connection. The connection is established between two terminal devices 41, 42, shown as computers, in each case via a customer service switch 43, 44, access networks 45, 46, and an ATM network 47 as a backbone network. A network management device 48, 49,  
30 50 is provided to manage each of these networks. Each of these network management devices is assigned, together with other network management devices, to a domain manager 51, 52. A service management device 53 has access to domain managers 51, 52 via a correlation matrix that  
35 is not shown in Figure 6. For purposes of exchanging data, customer database 16 is linked to the domain



managers and to service management device 53. Moreover, customer network management device 54 is connected to the service management device. The end-to-end connection from point A to point B is displayed on a screen 55 of customer network management device 54, making it possible for an operator to visualize the status of the connection and to intervene in case of errors.

~~{T}~~Some of the benefits of the device according to the present invention are elucidated in the following on the basis of an application example, where service and customer network management are made available for services based on ATM, frame relay, and leased link. For this, network management information from the following networks is to be integrated:

- 3 NMS for access components (B-NT-NMS, DTNMS and router NMS);
- 2 NMS for leased link (BFS, 46020);
- 3 NMS for ATM (Nortel NMS, 46020, NavisCore);
- 1 NMS for frame relay (Nortel NMS).

The relevance of the management information from the management perspective can be inferred from Figure 7.

From this it is apparent that, on the average, two interfaces are required per network management device in the direction of the service management devices; and five to seven interfaces per service management device in the direction of the network management devices.

Figure 8 depicts the interfaces required at the domain managers in the direction of the individual networks and vice versa; while Figure 9 illustrates the interfaces required between the domain managers and the service management devices. One can discern that, regardless of the number of service management devices and

independently of the service modeling, only one interface is needed for each network management device. The advantages are particularly evident by the reduction in the load on the network management devices and the networks resulting from the transfer of management information. Also, the number of subnetwork management devices to be integrated per domain is substantially less than the number needed for a direct integration.

10 The correlation matrix can be used to properly channel the information relevant to the individual service management devices by performing a one-time correlation to administrative customer data. Customer network management server 15 ~~is~~can be interfaced in such a way that all information relevant to customer network management is acquired via the correlation matrix as service-spanning information, but is provided with customer and service identification.

~~{Abstract}~~ABSTRACT

~~{In the case of a}~~A device for controlling a telecommunications system made up of a plurality of networks, the networks being designed for services or parts of services, a network management device being assigned to each network, and the network management devices being controllable by service management devices, in order for the service management devices to access network management devices, domain managers are provided, which, in turn, have access to selected network management devices and are each able to be linked to a service management device.